(202) 329-8711

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March 19, 1975

Mr. Gordon Moe
Military Technical Advisor
National Security Council
Room 302-A
Old Executive Office Building
17th & Pennsylvania Avenue, N.W.
Washington, D.C. 20506

Dear Gordon:

When we last talked, I promised you a more explicit description of the problem I outlined verbally. Here it is. As you see, it is only a subset of the broader political and military problems associated with a world food shortage. However, it is a problem that the government is surely going to have to resolve - the only question is whether it will be resolved before the panic for information begins, when it can be approached in a deliberate and rational way, or after, under the time and political pressure that will inevitably result. It is also a problem that is sufficiently circumscribed to be amenable to definition and, hopefully, resolution.

I have put this in a form which I assumed would be most useful to you and, of course, I wrote about the problem as I remember it last summer. If some things have changed, please feel free to take liberties with the text to make it accurate, or more appropriate to your needs.

Sincerely,

D. H. Steininger

DHS/nh
Enc.

WHEN
FROM CLASSIFIED DISCLOSURES

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TO: Gordon Moe
National Security Council Staff

DATE: March 19, 1975

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FROM: Donald H. Steininger

SUBJECT: Prediction and Monitoring of World Food Production in Time of Acute Shortage and Famine (U)

(U) The imminency of adverse changes in climate and weather and the impact these changes will have on world food production and population survival has become a subject of concern among an increasing number of people within the government. Few would now argue with the proposition that there is a very high probability of severe world food shortages within the next decade, and massive starvation. The recent CIA publication on the subject and a summary by Walter Orr Roberts (both attached) describe the situation succinctly

(U) But even though there is general intellectual agreement that this crisis is coming, and even though it clearly has a much greater potential for serious consequences than have so far resulted from the current energy crisis, very little formal activity is underway to prepare contingency plans for the political and military scenarios that might accompany a global food crisis, or to mobilize to meet some of the more obvious requirements that such a crisis will impose.

(U) Understandably, the current energy and domestic economic problems are demanding so much attention that it is difficult to generate significant activity on a future problem however serious; and this difficulty is compounded by the overwhelming complexity of the social, political, economic and military interactions that must eventually be considered. Perhaps because of these difficulties in mobilizing available analytic resources, any comprehensive study of the problem must wait until the food crisis becomes sufficiently current to compete with energy and the economy for the full attention of decision making levels of the government.

(U) There is, however, one consequence of a growing food shortage that is both predictable and susceptible to analysis and resolution now, before the crisis comes upon us: as a food shortage becomes apparent, policy makers will begin to require and to demand timely information about the status and future prospects of food production. Past publicity about ERTS leads to an assumption that a capability to give such information will soon be in hand; and, in fact, pilot experiments conducted over the past two years gives evidence that this is a realistic expectation. Whether such a capability will be available, however, depends on how quickly some crucial technical, organizational and security problems can be resolved. Until they are, they will continue to hinder the program planning and the experiments that are required to develop an operational capability.

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Unauthorized disclosure subject to criminal sanctions

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(U) This then is one important aspect of the overall food shortage problem which is susceptible to being addressed now, in anticipation of a highly likely, perhaps inevitable requirement. The unresolved issues involve security and classification, technical and procedural approaches to the problem, organizational roles and missions, and the political consequences of international concerns about national privacy. They therefore cover a broad enough spectrum of problems to suggest the NSC staff as the only organization with sufficient overview responsibilities to initiate a review. The fact that the possible solutions must eventually be weighed against their technical viability suggests that an NSC sponsored technical panel may be a convenient and appropriate mechanism to lay the ground work for an eventual decision.

The Current Situation

(U) Some very valuable work has been done by NASA and collaborating agencies over the past few years in developing techniques for monitoring and predicting food production, but now political, security and organizational problems are hindering the development of an operational capability. 25X1

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SECRET

(S) 2. The security classification surrounding the photographs from the reconnaissance satellites, and the "fact of" satellite reconnaissance itself, makes the integration of these photographs and the ERTS images a difficult process which can be accomplished only under special and somewhat restrictive arrangements. There is a

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[redacted]

produce unclassified maps and data which can then be used by NASA and Agriculture in their regular interpretation facilities. However, because of the security requirement to protect the fact of satellite reconnaissance, sanitization is a straight-forward matter only in those few geographical areas for which aircraft derived photography is a plausible cover. For most overseas areas, where sanitization is not easily accomplished, the number of people who can participate in the integration of information from the classified satellites and from ERTS must be limited to a degree that reduces the effectiveness of the interpretation process.

(S) 3. Over the past few years, a number of countries have expressed concern that the use of ERTS-like satellites constitutes an invasion of their national privacy, and there is a possibility that within the UN sanctions against such operations will be sought or proposals for international control will be offered.

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(S - Cont.) - If action is brought in the UN against ERTS, it may also be extended to our reconnaissance satellites which, although an official secret, are a publicly recognized fact. This potential threat to the viability of our reconnaissance operations is of great concern to the NRO. Whether this threat is real - that is, how likely it is that we would limit our reconnaissance operations because of protests within the UN - is a question that deserves attention in itself. However, if it were judged to be a realistic concern, then it may be necessary to consider suggestions that have been made to subsume under the auspices of the NRO those functions and images of ERTS essential to world wide grain monitoring. This suggestion assumes that these functions could then be hidden from public view, thereby removing the reason for any UN action against ERTS itself. The technical feasibility of hiding such functions is an open question.

(S) 4. There has existed within the OMB a strongly held opinion that the reconnaissance satellites could by themselves perform the essential resource monitoring functions, and that ERTS is therefore a superfluous capability. This is a technical question which is central to the resolution of the overall problem.

(S) 5. NASA, the Agriculture Department and the Interior Department each have organizational interests in the interpretation and processing of the data for world crop predictions. NASA has mobilized an impressive group of people to deal with the processing and interpretation problem; it controls the ERTS satellite and has enthusiastic support for the program at the highest levels of the organization. However, its charter includes only the responsibility for the experimental program. Agriculture's historical role in domestic and world crop forecasting with traditional data sources gives it a basis for assuming it would control an operation satellite system and, as an organization, it has a bureaucratic interest in taking on this mission when the time comes. However, its leadership has shown little intellectual enthusiasm in preparing for this role and the organization has only a small group of people with expertise in the new forecasting techniques. As a result, even if NASA were anxious to build a

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(S) 5. (Cont.)

bridge to another organization in order to expedite planning for an operational system, it would find Agriculture a sluggish partner to work with. NASA, however, is not fully motivated in this way - it naturally harbours some hope that the operational responsibility may fall to it by default. Consequently, the program planning needed to move quickly to a fully functional capability is not taking place. The planning is made even more difficult by the need to integrate classified data into the total operation, a requirement which gives the Department of Interior [redacted] and the DOD a voice in the bureaucratic negotiations. 25X1

(S) 6. There is a growing tendency on the part of the Administration to be more open about the existence and operation of photographic reconnaissance satellites; the complete declassification of the "fact of" such operations, and therefore of photographs of lower resolutions, is a possibility. (Actions resulting from the Freedom of Information Act may in fact force the government to take this step if it does not do so voluntarily.) If this occurs, a number of restraints that currently limit the range of solutions to any plan for future crop forecasting operations will be removed, and a broader set of procedural and organizational solutions can be considered. If the added options are sufficiently attractive, their potential availability should be given some weight in the decision about declassification.

Some Key Questions

(S) If we are to have a fully operational food monitoring system within the next few years, decisions on a number of questions must be made soon:

- What organization will be responsible for data processing, analysis, and reporting on world food production, once the forecasting capability can be considered operational?

- How much resources should be devoted now to the development of the operational capability?

- What arrangements, physical and organizational, should be made to facilitate the integration of classified photography with the unclassified data?

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(S - Cont.)

- What should our policy be with regard to acquiring the necessary ERTS pictures? Should we continue unilateral acquisition? Should we seek bilateral agreements? Should we try to "classify" what we do?

- How should we treat the ERTS images and the analytic reports and predictions - unclassified and publicly available? For official U.S. use only? Classified?

- How should we respond to attempts within the UN to interfere with free acquisition of ERTS imagry? To interfere with our reconnaissance operations?

- Anticipating a world in which many of the less developed countries are experiencing massive famine and are suspicious of every food distribution decision made by the U.S., should we consider international (UN) participation in ERTS operations?

(S) These are all issues which can only be judged by the highest policy levels. However, before they can be addressed a considerable amount of work needs to be done to identify and illuminate the facts and considerations that bear on these issues. Some of the more fundamental of these could effectively be handled by an NSC panel. For example:

- From a technical standpoint, is a good production forecasting capability a realistic prospect? How accurate and timely would it be?

- How soon could a useful capability be in operation?

- Are the present activities in NASA and Agriculture properly structured and adequately staffed to lead to this capability within this time? If not, what additional resources or reorganization is needed?

- What is the value of reconnaissance photography to the fully operational, monitoring and forecasting capability? Could the reconnaissance systems alone provide all the imagry needed for timely monitoring and prediction, making ERTS unnecessary? Or is the classified photography only an essential supplement to ERTS? If either is so, what frequency and quality of coverage is required? Or, finally, can ERTS be expected to do the forecasting job without assistance from reconnaissance satellite coverage, once the techniques are learned and baseline data established?

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(S - Cont.)

- What facility and organizational alternatives are available for bringing the classified photography together with ERTS imagry in an environment which would facilitate the interpretation and the sanitization of the data?

- Would significant benefits to an operational crop forecasting program in terms of cost or effectiveness result from a decision to declassify the "fact of" satellite photography?

- What technical options are available with respect to maintaining U.S. privacy over some of ERTS image acquisition activities? Could the existence of selected images (such as, for example, pictures of countries from whom permission has not been obtained) be kept out of the public domain?

- Assuming a possible desire to accommodate UN pressure for international participation in ERTS operations, what are the technical possibilities that are available with respect to active involvement of other countries in the planning for satellite coverage and in the distribution and analysis of the data?

(U) Clearly there are other relevent questions that must be dealt with that are beyond the capability of a panel. However, the answers to the above questions seem to provide the foundation for other considerations and may in fact stimulate the collaborative studies that will be necessary for final resolution of the problem.

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Program in Science, Technology and Humanism
303-494-5151

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3 March 1975

Orr Roberts
or

Memorandum to: Sol Buchsbaum, Chairman
Defense Science Board

From: Walter Orr Roberts

Subject: Key Issues of Interest to DoD in Weather and Climate Change

Introductory

The impact of changes of weather and climate is huge. Nearly every aspect of human life is affected. I am concerned that I have not seen more attention by DSB to the advancing front of knowledge of prediction and control of weather and climate, nor to the military consequences of probable future climate scenarios. This memo, thus, highlights a few of the key issues that I envision to be of great present and potential DoD significance.

As I mentioned at the meeting on 28 February, I will prepare a 30-minute briefing on this for a future DSB meeting, if you wish and we have time on the agenda. I cannot be at the Summer Study, alas.

The State of Knowledge

Historical records document, to varying degrees of certainty, the following salient points:

(1) Climate fluctuates with large amplitudes, in terms of human response, and over all time scales. (Climate is usually defined as the time-average of weather elements over any specified period.)

(2) Abrupt changes have historical precedent. (For example, around 550 BC the N. Europe winter worsened, leading in about 3 years to a shortening of the growing season by 20-30 days; the change persisted for centuries.)

(3) From about 1890 to 1940 North Hemisphere (and probably world) temperatures rose significantly ($\sim 0.7^{\circ}C$), especially at high latitudes, leading to increasingly favorable world agriculture just as world populations zoomed upwards.

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(4) A cooling has now set in, with adverse agricultural consequences in spite of today's greatly improved agronomic practices. (In the USSR growing seasons are now two weeks shorter than in 1940-50, and droughts more frequent.) The 1972 and 1974 crop failures, as well as the drastically lower world cereal reserves, and the rocketing food prices reflect this change and thus is all made worse by the rising food purchasing power of the wealthy nations and the upwards spiral of world populations.

(5) For over 150 years there have been 20-22 year recurrent droughts in the high plains area of U.S. just east of the Rockies. There is some evidence that this is related to solar activity. If so, this has far-reaching consequences for theory, for practical forecasting and for possible human intervention.

Experts differ, with sometimes unbecoming passion, on the explanations. Arguments rage over whether the present and undisputed temperature downturn is a chance fluctuation likely as not to reverse next year, or a trend likely to persist for 25-50 years.

The competing theories for climatic change encompass the following, and more:

(1) Volcanic activity adds a dust veil in the stratosphere, reducing incident solar energy at the earth's surface.

(2) CO_2 enrichment of the atmosphere, resulting from human use of fossil fuels, is increasing the blanketing of outgoing IR while not reducing incoming sunlight (often incorrectly called the "greenhouse effect").

(3) Ocean temperatures, driven by winds and other factors, influence air temperatures, radiative balance, and the large scale atmospheric flow.

(4) Solar activity (especially the solar wind and the cosmic ray modulation) affect physical processes of the stratosphere and below, perhaps upsetting the atmospheric radiative balance of the earth, and through this, influencing stratospheric and tropospheric circulation.

(5) Man-made small-particle dust and waste heat released to air and water are affecting the radiative system.

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(6) Polar cooling, now in progress, results in the greater frequency of extremes of drought, flooding and other anomalies, and in dislocations of the large scale circulation that have particularly serious implications for the semi-arid and otherwise marginal lands into which husbandry and settlement are increasingly migrating.

(7) Unpredictable "self-fluctuations" perturb climate.

(8) Etc., etc.

Probably no single cause can explain all climatic changes. But no theory has a solid theoretical or experimental basis so far.

Key Issues

The key issues for DSB (and the Nation) to take a look at, in my view, are the following:

(1) Severe food shortages are almost inevitable in the decadal time frame on all hypothesis of climate and weather change. These are bound to be politically unsettling. (Ethiopia and India and Bangladesh are examples. Future disasters could be catastrophically severe, and it is possible that 100 million could starve). Some analysts believe Kruschev fell from power in part because of the failure of his dry-land farming policies (including support of Lysenko, whose effect on agriculture was a serious setback). Soil erosion, forest fire damage and other effects of droughts can influence the economy of a region for 15-25 years, as witness the "Dust Bowl" and the Sahel region, to say nothing of the long-term intellectual impact on mal-nourished children of even two years of deprivation.

(2) The US and Canada are slated for further increased roles as the world's food suppliers, with all the favorable and unfavorable social, political, economic and ethical implications that this inevitably will bring. (We'll be increasingly blamed if people starve, I suspect, even though without our food there would be still less.)

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(3) The USSR has no way to be independent agriculturally, in the long term, if their food consumption habits continue to rise; the USSR is also far more vulnerable to climate change than we. The evidence is impressive that such a change is taking place for the worse right now. The USSR will be a food importer from US in nearly every imaginable scenario of the coming 25 years.

(4) This country has no visible contingency plans for not-so-improbable global food disaster. We appear not to have explicit long-term policies to build food reserves, stabilize food prices, or to provide farm price supports to assure farmer incentive for high food production in US.

(5) Research on climate change is not being forcefully advanced. Lip service is widespread, but unless or until our theoretical and observational work gets much stronger support, we are going to make slow progress in:

a. Theory of climatic change;

b. Testing of alternatives through laboratory experiments;

c. Expanding the observational data base for testing theories;

d. Provision of computer time for climate model experiments which make large computer capacity demands but are essential for progress;

e. Building manpower--competence in this domain is thin.

(6) There is no major push that I know of to exploit the potentialities of the new genetic manipulation schemes (ie insertion of the precise amino acid in genetic structure to produce enhanced protein yield in a true-breeding corn) that are suggested by the recent spectaculars of genetic research.

Some Speculative Considerations

The question is often raised whether human activity through pollution, heat dumping, freon release, SST operation, smog generation,

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etc. is modifying climate and weather. Work is proceeding systematically if slowly on these important issues.

However, a good deal of evidence exists suggesting that the weather-climate system is, at times at least, only conditionally stable to small perturbations. There is some evidence that very small energy releases, critically timed and geographically located, could trigger large and possibly long-lasting changes. There are speculative areas associated with stability considerations that need quantitative exploration suggesting awesome consequences of deliberate or inadvertent interventions.

Geophysical warfare, at climate time scales at least, presumably was banned, so far as US and USSR are concerned, by last July's somewhat ambiguous Nixon-Brezhnev "Joint Statement on Environmental Warfare." It appears, to me at least, that these bans were made in absence of any sophisticated or detailed discussion of what sorts of possible trigger-mechanisms may be inherent in the natural system. And this is understandable. But, I believe, that these trigger possibilities must have far more careful long-term study. We do not know where the triggers are, how sensitive they are, who can gain access to them, or even towards whom the gun is pointed.

- End of Memo -

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LETTER TO: Mr. Donald H. Steininger
Xerox Corporation
Stamford, Connecticut 06904

SUBJECT : Prediction and Monitoring of World Food Production in Time of Acute Shortage and Famine

25X1 O/DDI: [redacted] :lm (3 November 1975)

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